

Australian Marsh Beetles (Coleoptera: Scirtidae). 1. Additions to genus *Petrocyphon*.

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Abstract

Twelve new species are described in the genus *Petrocyphon*, raising the number of known species to 19. Supplementary information on several previously named species is also provided. There is greater morphological diversity in the genus than previously known. Males of several species have separate, basally not connected parameres, females of several have large complex prehensors, some also a pair of intricately structured sclerite plates or large rings on the walls of the seminal receptacle. Resemblances of *Petrocyphon* with the *micans*-group of genus *Ypsilonocyphon* are indicated.

Zusammenfassung

In der Gattung *Petrocyphon* werden 12 neue Arten beschrieben, die Zahl bekannter Arten steigt auf 19. Ergänzende Informationen zu bereits benannten Arten werden ebenfalls vorgelegt. Die morphologische Vielfalt in der Gattung ist größer als bisher bekannt. Männchen mehrerer Arten besitzen getrennte, basal nicht verbundene Parameren, Weibchen von mehreren Arten haben große komplizierte Prehensoren, manche auch ein Paar kompliziert strukturierter Platten oder große Ringe auf den Wänden des Receptaculum seminis. Auf Ähnlichkeiten zwischen *Petrocyphon* und der *micans*-Gruppe der Gattung *Ypsilonocyphon* wird hingewiesen.

Keywords

Taxonomy, morphology, new species, redescriptions

Introduction

The present paper is a spin-off from an ongoing revision of the small *Cyphon*-like Australian Scirtidae. Members of genus *Petrocyphon* are small to very small slender beetles. Small body size was an important selection criterium when loans from several Australian museums were issued. Specimens of the then still unknown genus *Petrocyphon* were therefore included in the loans, even though their habitus is not very *Cyphon*-like.

The genus *Petrocyphon* is one of the few Australian scirtid genera which can immediately be recognised by “small size, elongate shape, relatively narrow pronotum with shallow groove along posterior edge, proportionally long antenna particularly in the males, ... strong punctuation, strongly raised genal ridge and inner edges of pronotal epipleura, moderately large distance from edge of eye to genal ridge and short relatively broad mesoventral process. The notch on the mesoventrite to accommodate the pronotal process is distinctive, being strongly transverse, with posterior angles sharp and each angle opposite a small, raised, acute, point on the posterior margin of the metaventrite” (WATTS 2011).

The degree of sexual dimorphism of the antennae differs between the species. Relative antennal length is a secondary male sexual character which varies also individually; see under *P. wattsi*. The generic name was intended to refer to the long, wing-like antennae (WATTS 2011). Through an inadvertant reversal of letters the stem syllable turned from pter- (Greek, wing, feather) into petr- (Latin, rock, stone).

Twelve new species were found among the less than 70 specimens available for the present study. Probably many more remain to be discovered. At present, the number of known species is 19.

Supplementary information on several known taxa contained in the present material is also presented.

Methods, depositories, and abbreviations

Entire abdomens were removed and cleared in cold concentrated KOH-solution over night. Only then can parts that lie far forward in the abdomen be recovered. This particularly concerns seminal receptacles with

their sometimes striking ornamentation, occasionally also prehensors. Rinsed abdomens were dissected under a WILD M5A dissecting microscope at magnifications up to 50x. Parts were mounted in Euparal on transparent small pieces of plastic material (Worblex; unfortunately, no longer available) that were covered with a small cover slip and ultimately pinned beneath the specimen card. Preparations were examined with a compound Leica DMLS microscope equipped with a drawing tube, at magnifications up to 630x. Measurements of body size are in mm, of genitalia in μm .

The study material was borrowed from and returned to several museums; depositories are given in parentheses in the specimen list. They are abbreviated as follows:

AMS	Australian Museum, Sydney
ANIC	Australian National Insect Collection, Canberra
MNHW	Museum of Natural History, Wrocław University; material to be ultimately deposited in ANIC
MV	Museum of Victoria, Abbotsford
MZL	Museum of Zoology, London
QMB	Queensland Museum, Brisbane
CMNO	Canadian Museum of Nature, Ottawa
PZ	Collection P. Zwick, Schlitz
SAMA	South Australian Museum, Adelaide; including coll. C.H.S. WATTS

Information on labels is given in full. Slashes separate different labels on the same pin. Occasionally label information was supplemented in square brackets, for example by geographical coordinates obtained from Bonzle Digital Atlas of Australia or Google Earth, respectively.

The following abbreviations are used in descriptions and/or illustrations:

A1 to A11	Antennal segment numbers. A1 = scape, A2 = pedicle, A3 = basal flagellomere.
BL	“body length”.

Most Scirtidae bend the head under the thorax, the head is often not visible from above. It is therefore practical to use the length of pronotum plus elytra as a proxy of body size by measuring in dorsal view from the front margin of pronotum to the apex of the elytra, thus excluding the head (Klausnitzer 2009). This procedure was followed here, even though in many *Petrocyphon* specimens the head is exposed. The present procedure results in slightly lower length values than given for the same species by WATTS (2011).

pa	paramere
pd	parameroid
pe	penis
T8, S8	tergite 8, sternite 8; also in combination with other segment numbers. Counts are of morphological segments. For example, the first freely visible sternite is actually S3.
tr	trigonium

Morphology and taxonomy

Descriptions of habitus are kept short because habitus, colour pattern, pilosity, punctuation, relative length of antennal segments and the like provide only auxiliary characters in species distinctions. In all species, punctures on head, pronotum, and scutellum are sharp little granules, those on the elytra are impressions. Elytra with very faint, caudally converging, longitudinal plicae. Both sexes with a row of raised granules near the front edge of S4 and S5.

Species descriptions focus on genital characters which are decisive for reliable identifications. The following applies to all species, unless differently stated.

Males. Plate of T8 simple, caudally rounded, with microtrichia but without macroscopic hairs. The paired anterior apodemes (bacilla lateralia of Nyholm 1969) are not much longer than the plate. S8 undeveloped in most species but present as a weak V-shaped sclerite in the *P. tasmanicus*-group. Apodemes of T9 distinctly longer than those of T8 but plate soft, barely sclerotized, bare. Caudally, T9 blends with membranes in the anal area. S9 is a membraneous caudally notched minute structure with some caudal hairs.

Tegmen and parameres (which together represent the dorsal part of the phallic complex) and the penis proper

(composed of the basal pala which supports the median trigonium and the lateral parameroids) differ much between species. The parameres are often longitudinally divided into two or even three branches.

Several species have asymmetrical male genitalia. There is a tendency for the two parts of the phallic complex to be closely interconnected, for example by clasping the opposite part in some fold. *P. bihamatus* possesses interlocking hooks and forks. In the strongly asymmetrical genitalia of *P. messatos* and *P. convolutus* one paramere is firmly held by modifications of a parameroid.

Females. Ovipositors are not characteristic. In some species the front ends of the apodemes of T8 converge in an arch but the tips do not merge. Shape and structure of prehensor differ much between species, but several species do not have any. Previously undescribed complexly structured rings or sclerified discs on the sides of the membranous seminal receptacle occur in several species. They may secondarily be lacking in the others. The structures in question are very delicate. Where nothing alike was observed, accidental loss during dissection cannot be excluded in case only a single female was available.

Species Groups

To facilitate identifications species are assigned to groups with similar male morphology. Whether these groups have some phylogenetic significance is uncertain. Female morphology would provide an opportunity to check but presently too few females are known. Distinct rings or discs on the spermatheca occur in several groups defined by male morphology. The *antarcticus-wattsi* species pair is a monophylum that differs much from all other species.

The key below is to morphological groups, plus two isolated species. Within groups, species descriptions are presented in alphabetical order.

Key to species groups based on male genital morphology

- 1 Tegmen and parameres form a sort of pocket in which the bag-shaped penis rests. It contains an eversible armature of large spines. Parameres and parameroids are stiff rods. S8 a weak V-shaped sclerite. S9 well developed, sclerotised, ending in two divergent tips*antarcticus*-group
- 1' Variable, but none of the above characters applies(2)
- 2 Penis and parameres curved, facing each other, their bases joined in a basket-like structure*P. ovium*
- 2' Variable, but base of penis not connected to base of parameres.....(3)
- 3 Parameres basally connected..... *tasmanicus*-group
- 3' Parameres separate, their bases not connected(4)
- 4 Parameres similar.....*bihamatus*-group
- 4' Left and right paramere strikingly different, penis strongly asymmetrical.....*messatos*-group

The *antarcticus*-group

Petrocyphon antarcticus WATTS, 2011
(Figs.1 -5, 22)

Material. 2 ♂, Cradle Mtn. Tasmania CARTER & LEA / on King William Pine; 1 ♂, 1 ♀, Cradle Mtn. Tasmania CARTER & LEA (SAMA). 3 ♂, Cradle Mt. Tasmania J. ARMSTRONG [originally mounted together on single card]; 2 ♀, 42.10S 146.07E 4km SSE of Mt. Rufus 800 m TAS 26-28 Jan 1980 LAWRENCE & WEIR; 1 ♀, Australia: Tasm. Rufus Canal, 13.5 km WNW Derwent Br. 800m 26-28.i.1980 Nothofagus rainf. A. NEWTON, M. THAYER / Pyrethrin fogging treeferns; 1 ♀, 42.06S 146.10E Lake St. Clair 750 m TAS 23-25 Jan.1980 LAWRENCE & WEIR / pyrethrin spray treeferns; 1 ♀, 42.10S 146.08E TAS 9 km WSW of Derwent Bridge 21 January 1983 I. NAUMANN, J. CARDALE (ANIC). 2 ♂♂, 1 ♀, Australia, Tas., 10 km S Hellyer Riv. Jan.10, 1984 L. MASNER, s.s. / Old Nothofagus forest with *Asplenium* (CMNO).

Habitus. BL 2.0-2.1 mm. Uniformly dark brown. Male antennae almost as long as the entire beetle. A3 resembles A2, thick, barely half as long as A4.

Male genitalia. T8 wide, caudally concave. S9 large, consisting of two slightly sinuous horns from which slender struts extend forward, converge and then diverge again before the indistinct front edge of the sternite. Tegmen base regularly U-shaped, sclerotised along midline to about midlength. The parameres are slender processes separated by an oval window. Each paramere with a large ventral flange that surrounds the penis on the sides. Paramere tips armed with small asperities. Penis an oval body containing an eversible sperm duct. The parameroids project as two struts with external serrations. Trigonium replaced by a transverse dark cap over the end of the sperm duct. A long narrow sclerite band originates from the ventral side of the cap. Sperm duct armed with slender large spines arranged in a wide median and two narrower lateral bands. All spines of similar size and much larger than two regular caudolateral bands of short triangular teeth.

Female (presumed). Several sclerotised rough patches and a body resembling a tulip flower occur in the oviduct and are easily observed. In front of them is a drum-shaped section into which is folded back a portion of the duct that appears faintly striate and bears minute needle-like structures. When this section is extruded it leads to the hyaline receptacle which has two round patches provided with minute microtrichia arranged in groups of 2-4. In one incompletely cleared specimen a duct, presumably from the ovaries, enters at the border between drum-shaped and striate sections.

Notes. *Petrocyphon antarcticus* is the type species of the genus. Except for the next species it differs from other members of *Petrocyphon* in important structural details, as is also apparent from figures 57 and 58 of the original description. Large numbers of *P. antarcticus* were recorded from various parts of Tasmania and seemed to be the only species on the island (WATTS 2011). However, not every listed specimen had been dissected (C. H. S. WATTS, in a letter). In fact there are four Tasmanian species, possibly even more. The distribution of *P. antarcticus* on Tasmania needs study. I have seen it only from Cradle Mt. and the highlands south and southwest of it.

***Petrocyphon watti* n. sp.**

(Figs. 6-14, 23)

Type material. Holotype ♂, 4 paratype ♂♂, Tasmania A. SIMSON / 3361 (SAMA). 2 ♀♀, Tasmania A. SIMSON / 3361 (SAMA). SIMSON's notebooks, held in the South Australian Museum Archives, record 40 specimens of species 3361 as having been collected 'on myrtle blossom' and 'on window' at 'Lottah Blue Tiers' between '25 Nov & 14 Dec 1878' and 1 'on window pane' at same location between 'Nov 12-Dec 6 1876 (C.H.S. WATTS, in a letter) [Lottah is at 41°12.548' S, 148°01.283' E, ca. 495 m a.s.l.]. 1 ♂ paratype, 5196 Tas. [red ink on mounting card, apparently coll. BLACKBURN] (SAMA).

Habitus. BL 1.8-2.4 mm in males, 2.0 and 2.1 mm in the presumed females. Brown. A3 distinctly longer than A2, thick, half as long as A4. Length of male antennae variable. Negative allometry with body size leads also to different proportions of antennomeres (Figs. 11, 12-14).

Male genitalia. Described in comparison with *P. antarcticus*. T8 is narrower, caudal notch narrower and deeper. T9 with straight apodemes that have a distinct outwardly directed branch supporting a weak plate. It is unsclerotised in its centre and caudally inseparable from membranes around anus and endgut. Horns of S9 outwardly curved, not sinuous, at base closer together than in *P. antarcticus*. Tegmen stouter, parameres separated by a parallel slot. Asperous area on paramere tips longer. Penis more slender, with anterior nipple-like tip and long slender parameroids. The cap on the sperm duct is pale and covered with small teeth. It lacks a ventral sclerite spur. Sperm duct armed with slender spines of different size and shape. The about 6-8 anteriormost teeth in the middle are huge straight spines with distinct sockets. Their tips conceal a group of much smaller curved spines caudally from which the median spinule band becomes narrow and is composed of small elements. The lateral bands consist of middle-sized slightly sickle-shaped spines. The regular bands of short triangular teeth are further in front, between lateral and median bands of spines.

Female. Behind a ring fold in the oviduct a pair of raised ribs covered with spinules plus a pair of large flat areas covered with asperities are observed.

Notes. The two related species may be allopatric. Named for C.H.S. WATTS, Adelaide, who created the genus and helped in several ways with this paper, also by providing the collection data from SIMSON's notebook.

The *tasmanicus*-group

The group definition is based on the basal connection between the parameres which is a plesiomorphic character expression shared with most small Scirtidae. In *P. cataractae* the bases of parameres are joined in a narrow loop. *Petrocyphon arktous* WATTS, 2011 may be similar.

The remaining species share a characteristic structure of tegmen and parameres and probably form a monophyletic subgroup. The tegmen forms a bracket over the penis base. It supports large parameres on the sides. Each is divided into two or three elongate branches. One branch is positioned alongside the penis, the other(s) beneath it. *Petrocyphon dorrigoensis* WATTS, 2011 may belong here but was not available.

Within this subgroup, *P. julianae*, *P. phoenix*, *P. lamingtonensis* and *P. tasmanicus* share a dorsal flange along each side of the penis. It is best seen in lateral view and is anteriorly high but lowers gradually (for example, Figs. 42, 51) or abruptly (for example, Figs. 36, 45) as it extends onto the parameroid.

***Petrocyphon cataractae* n. sp.**
(Figs. 15-19)

Type material. Holotype ♂, 17.30D 145.37E QLD Millaa Millaa Falls 18 Nov. 1994 C. REID coll. rainforest (ANIC).

Habitus. BL 2.0 mm. Pronotum with a pair of caudally convergent paramedian depressions before the end. A horseshoe-shaped postscutellar depression across the light brown elytra. Antennae about 2/3 of total length, flagellar segments are narrow cylinders. A4 is unusually long and at least 5-6 times longer than A3. A3 is a minute sphere.

Male genitalia. On T9 a line of grouped microtrichia seems to follow the (invisible) caudal edge of the plate separating it from membranes in the anal area. S9 a soft hairy lappet of irregular shape supported by two angularly bent weak sclerites. Penis composed of two convergent sclerite rods which support the trigonium at about 1/3 of their length. Caudally they continue in straight line forming the slender distally flattened parameroids with some asperities along their outer face. Base of trigonium curving strongly ventrad and then turning caudad as a broad, caudally tapering leaf with strongly serrate edges resembling the sterile fronds of basket ferns. Near the base two small ear-shaped sclerites spread sideward, leaning against the rod-like base of the parameroids. A hairpin-like strong sclerite supports the slender caudally tapering parameres. Their external face is beset with small hooks or teeth, several of which are connected by faint longitudinal ridges.

Female. Unknown.

Note. No similar species is known. The basally open penis base is unusual, breakage cannot be excluded. The beetle was taken near a waterfall which suggested the Latin name meaning of the waterfall.

***Petrocyphon flagellifer* n. sp.**
(Figs. 20, 21, 24)

Type material. Holotype ♂, Mt. Wellington Tas. Lea / Tasmania 8824 (SAMA). 1 ♂ paratype, Mt. Wellington TAS Lea (ANIC); 1 ♂ paratype, Hobart 91-88/ 2557 (MZL), 1 presumed ♀, Australia, Tasm. Gordon R. Rd. nr. Little Florentine R. 440 m 3.11.1980 Nothofagus etc., A. Newton, M. Thayer (ANIC).

Habitus. BL 2.0-2.1 in males, 2.6 mm in the presumed female. A3 distinctly longer than A2, little shorter than A4.

Male genitalia. The base of the penis occupies about half the total penis length before it divides into two closely adjacent straight smooth parameroids and the slender trigonium between them. Trigonium base directed obliquely ventrad, the finger-like distal part roughened on the outside and bent back towards the slightly longer parameroids. Ventrally on the penis base is a large process supported by a strong T-shaped sclerite. The large base of the tegmen arches over the base of the penis. Laterally, it curves ventrad and caudally supports the parameres which consist of

two very different branches. One alongside the penis resembles a membranous knife blade with a few asperities, mainly along the ventral edge. The other lobe is a well sclerotised short arm directed ventrad which supports a slender unsclerotised and colourless flagellum with about four sharp short spines at and near tip.

Female (presumed). The prehensor is a slender barely sclerotised body consisting of two caudally tongue-shaped elements on which numerous longitudinal folds are superimposed. Two pairs of pocket-like ends can be distinguished. No spines or other armature

Notes. The specific name means carrier of flagella, a reference to the spiny flagellum of the parameres

Petrocyphon julianae n. sp.

(Figs. 25-35)

Type material. Holotype ♂, NSW, Thredbo R. 6 mls downstream from Thredbo, 7.1.1973, in flight (leg P. ZWICK; ANIC). 6 paratype ♂♂, 1 ♀, Kosciusko Nat. Park, Smiggins Bog NSW 1600 m, 1983-1986 pitfall traps, Ken Green No.63 (ANIC & PZ). 5 ♀♀, NSW 5km N Smiggin Holes 9/2/02 C.H.S. WATTS (SAMA & PZ).

Habitus. BL 1.8-2.0 mm in males, 2.0-2.1 mm in females. Antennae longer than half body length in males, A3 about as long as A2 but much narrower. Dark brown, the sutural space can be entirely or in part reddish brown.

Male genitalia. Penis and tegmen slightly asymmetrical. The slender pala is anteriorly deeply excised, waisted, and occupies about 1/3 of total length. It supports two slender symmetrical parameroids which are longer than the trigonium and bear a dorsal flange. The long slender trigonium with simply rounded tip is articulated obliquely, the right articulation being much more caudal than the left one. At rest, the trigonium tends to be folded sideways, its tip being directed towards the right body side. Trigonium and other parts symmetrical. Base of tegmen U-shaped, the transverse part crossing over the pala. The sides are bent at a blunt angle and divide into a ventral colourless appendage resembling a grass leaf and a shorter slender sclerotised cone. The surface of the cone is densely covered with oval excavations which make it resemble a rasp. The parameres differ slightly in length (Fig. 30).

Female. T7 (concealed under the elytra) with large oval caudal notch. A large prehensor is formed by a pair of double folds, each pair with a median lamella that extends almost to the midline. Seminal receptacle provided with a pair of circular sclerites (diameter ca 300 µm) of which mainly the structured rim with its intricate cuticular meshwork is noticed. The area inside the ring has a very faint pattern of small polygons, and, near the rim, some minute raised scales (not seen in figure).

Notes. There is no similar species. Males are immediately recognized by the rasp-like portion of the parameres, females by the oval notch on tergite 7. The prehensor is also distinctive. The spermathecal sclerite rings are remarkable for their large size and the faint ornamentation in their central area.

Named for my daughter, JULIANE VON HAMM.

Petrocyphon nothofagi n. sp.

(Figs. 36-40)

Type material. Holotype ♂, Beech Forest, VIC., 11-19 Jan. 1932, F.E. WILSON [Otways; 38° 38.126' S 143° 36.561' E] (ANIC; antennae broken beyond A6). 1 ♂, paratype, Aire River 4 km S of Beech Forest, VIC., 4 Dec. 1972, NEBOISS & MALCOLM (NMV; head missing, genitalia naturally everted).

Habitus. BL 2.0 mm. Light brown. Antennae broken beyond A6, evidently short, A3 minute, half as long and thick as A2, ~ 1/4 the length of A4.

Male genitalia. Penis with long narrow base resembling a dorsally open semi-tube. Penis angled, narrow, in preparations it lies on the side. The basally wide parameroids gradually narrow to a slender rounded tip directed dorsad. They are flat, lack armature and remain closely appressed to each other in the everted genitalia. Between them the short sickle-shaped sharply pointed trigonium curves ventrad. Base of parameres anteriorly a thin rectangular frame. It widens caudally and supports the bifid parameres. The long ventral branches resemble a bird head with long neck. The lateral branches are straight sharply pointed processes, the left one longer than the other.

Female. Unknown.

Note. Both the name of the species and of the type locality refer to the original Myrtle Beech (*Nothofagus*) forests in the Otway Ranges. The most similar species is *P. lamingtonensis* which shares the curved very narrow penis with unarmed triangular parameroids basally supporting a large erect flange.

***Petrocyphon lamingtonensis* n. sp.**

(Figs. 41-43)

Type material. Holotype ♂, AUSTRALIA (E) QLD/NSW 23°42'S, 153°30'E Lamington N.P. Coomera circuit (W side) 12.08.2004 leg. M. WANAT [MNHW, to be eventually deposited in QMB].

Habitus. BL 2.0 mm. Light brown, antennal tips dark. Antennae long, about 0.7 times body length. A3 minute, half as long and thick as A2, ca 1/4 the length of A4 which is distally widened. Its front edge projects angularly near the caudal fourth. A5 is less widened, more distal flagellar segments even less, the last segments are cylindrical.

Male genitalia. The narrow curved penis is anteriorly excised and bears straight unarmed parameroids which end in long and slender tips. Basally each carries a large erect flange which appears prominently in side view. The trigonium is concealed between these lateral structures. It articulates with the penis sides caudally from mid-length and consists of a pair of strongly sclerotized short hooks, each with a lateral tooth. The narrow tegmen (torn) lying over the penis base supports the slender parameres which fork into three unequal flat branches. The paramedian one has the form of a short angularly bent hook. The lateral branch soon forks again into a very long and thin curved rod which is caudally spear-shaped, and a gently curved lateral branch. The lateral branch is much shorter than the middle one but distinctly longer than the paramedian hook.

Female. Unknown.

Note. The adjectival name refers to the type locality in Lamington National Park.

***Petrocyphon phoenix* WATTS, 2011**

(Figs. 44-46)

Material. 2 ♂♂, 2 ♀♀, 37.34S, 145.53E Cumberland Ck. 13 km ESE of Marysville 18 Jan. 1976 LAWRENCE & WEIR/ beating *Nothofagus cunninghami* foliage; 2 ♂♂, 5 ♀♀, 37.45S, 145.42S, Cement Ck. 5 km N of Warburton V. 17 Jan. 1978 LAWRENCE & WEIR (ANIC).

Habitus. BL 2.1-2.4 mm in both genders. Brown, dark specimens with reddish pronotum. Antennae about 3-4/5 total length, A2 spherical, A3 longer, conical, caudally widened, more than half the length of A4.

Male genitalia. Penis long and slender, symmetrical. Pala drawn out into two elongate anterolateral processes. The pala widens gently caudad, its sides turn into strong slender sclerites, centre transparent. Just basally from midlength the pala supports two sclerites which are directed mediad, turn abruptly caudad and merge to form the very long and slender trigonium. It ends in a small downcurved process. The rod-like parameroids are provided with a vertical flange and are longer than the trigonium. Middle of tegmen base widened, rhomboid, overlying the penis base. The arm-like sides turn caudad and after a short distance fork into two elongate structures. One is a hyaline piece that reaches almost as far back as the trigonium. The other is more sclerified and bears numerous delicate overlapping lamellae.

Female. All apodemes anteriorly widely separate. No spermathecal sclerites noticed. Ovipositor contains a flat sclerite, as shown; no prehensor.

Note. The caudal edges of lamellae on the dorsal paramere branch were mistaken for fine setae by WATTS (2011).

***Petrocyphon tasmanicus* n. sp.**
(Figs. 47-56)

Type material. Holotype ♂, 1 ♂ paratype, Tasmania A. SIMSON / 3361 [Lottah, Blue Tiers, according to A. SIMSON's notebook, see under *P. wattsi*] (SAMA). 1 ♂ paratype, 5196 Tas. [red ink on mounting card; apparently coll. BLACKBURN] (SAMA). 2 ♂♂ paratypes, 1 presumed ♀, 41.11S, 148.00E, TAS, Mt. Michael 740m, 27 Nov. 1989 Sweeping, Tube 202 H. MITCHELL (ANIC). 1 ♂ paratype, Launceston Tasmania J.J. WALKER/ G.C. CHAMPION coll. B.M. 1927-409 (MZL).

Additional material. 2 ♀♀, Launceston Tasmania J.J. WALKER/ G.C. CHAMPION coll. B.M. 1927-409 (MZL). 1 ♀, Launceston Tasmania 94-88 (ANIC-Prehensor-Foto). Identified with doubts: 2 ♂♂, 2 ♀♀, Australia, Tas., 10 km S Hellyer Riv. Jan.10, 1984 L. MASNER, S.S. / Old Nothofagus forest with *Asplenium* (CMNO).

Habitus. BL 2.0-2.1 mm, one female is 2.2 mm long. Dark brown. Antennae of male almost as long as the beetle. A3 resembles A2, thick, barely half as long as A4.

Male genitalia. Penis base narrow, widening caudally, greatest width is attained just before midlength. Caudally the penis narrows again, the parameroids and the slightly shorter lanceolate upcurved tip of the trigonium together form a slender cone. Near midlength the short trigonium has a small lateral angle resembling a blunt tooth. The wide part of the penis has a sideward bent dorsal flange which extends onto the parameroids and forms a deep fold in which the dorsal branch of the parameres rests. It is held in place by a small medially curved lappet formed by the beforementioned flange. Tegmen a transverse bar that crosses dorsally over the penis base, then turns forward and forks into two unequal paramere branches. The lateral longer pointed one lies in natural position alongside the penis while the axe-shaped ends of the shorter paramedian member lie under the penis, almost touching in the middle.

Female (presumed). Ovipositor not characteristic. Apodemes of T8 widely separate. Prehensor large, composed of two lateral elongate plates and a shorter conical median sclerite, all overlain by complexly folded cuticle. Seminal receptacle armed with two large sclerite rings of intricate fine structure.

Variation. In some males the lateral tooth of the trigonium is more pointed and distinct, and the apex of the shorter paramere branch is medially enlarged appearing more axe-shaped than in the holotype (Figs. 49, 50). There may even be some small marginal teeth. The folding pattern of the prehensor differs between specimens, possibly reflecting different functional status. Presumed females also differ in the distinctness and depth of a notch in the lateral sclerites of the prehensor.

Some specimens from the Hellyer River are assigned to *P. tasmanicus* with doubt. Both males possess a wider, laterally pointed front end of the pala, a distinct lateral tooth on the trigonium, and long complexly ornate paramedian paramere branches that are longer than the rod-like lateral ones. However, one male has one of the latter short and thick, the other thin and long. The prehensor of only one female was studied in detail. Its lateral sclerites are apically more deeply excised and the median sclerite is blunt and shorter than in the other specimens. These differences are thought to represent variations of a single species because the overall structural agreement in genitalia is striking. Other members of the genus, even the most closely related ones (for example, *P. antarcticus* – *P. wattsi*, or *P. convolutus* and *P. messatos*) are profoundly different in their genitalia.

The *bihamatus*-group

***Petrocyphon bihamatus* n. sp.**
(Figs. 57-60)

Type material. Holotype ♂, 1 ♂ paratype, 1 ♀, Mt. Kembla [34° 26.390' S 150° 47.297' E] NSW Oct. 1989 C. REID beating rainfor. bushes; 1 ♀, Narrara [33° 23.756' S 151° 20.747' E, a Sydney suburb] NSW 20.x.26 F.E. WILSON (all ANIC).

Habitus. BL 1.9-2.0 mm. Entire body light brown, one male with faint brown marks resembling *P. messatos*, see there. A crescent-shaped impression behind scutellum extends across both elytra. Antennae of male about 2/5 of total length, segment 3 a small sphere, as short as but much narrower than pedicel. Antennae of female shorter but segment 3 relatively longer.

Male. Penis slender, symmetrical. Near midlength, the pala supports the narrow long trigonium which has a small longitudinally grooved apical knob. Laterally from the trigonium insert long parameroids and, further laterally on each side a large flat hook. The parameroids are gently curved distally tapering soft blades and longer than the trigonium. Two separate rod-like parameres, symmetrical. Near midlength a short branch forks out to the outside. Another short branch pointing straight back forks out of the main stem near 3/5 of total length. The main part of paramere curves gently dorsad. Penis and parameres closely interconnected. Each paramere embraces one of the large hooks on the penis. The short ventral branch of the paramere lies to the outside, the long main branch to the inside of the hook.

Female (presumed). Ovipositor not distinctive. Prehensor in side view a large oval body over a sinuous elongate base, details not known. Receptacular discs about 250 x 220 μm , entire surface covered in dense cuticular meshwork. Each disc carries a protruding kidney-shaped wart.

Notes. The name is a Latin adjective describing the paired hooks at the penis base. Both sexes differ much from other species.

Petrocyphon collessi n. sp.
(Figs. 61-65)

Type material. Holotype σ , paratype φ , Mt. Edith Forest Road 1 1/2 m off Danbulla Road N.Qld. 6 May 1967 D.H. COLLESS (ANIC).

Habitus. BL 1.8-2.0 mm. Head and pronotum orange-brown. Elytra light brown with darker marks along the sutural space (except the caudal fourth) and near the scutellum, plus two transverse fasciae, one before midlength, the other before the caudal fourth of the elytra. The brown mark along the suture is separate from the first fascia but in contact with the second. Appendages yellowish, the last 3 flagellar segments increasingly infusate.

Male. Penis very long and slender. The pala is a long semi-tube over a trough which is ventrally closed. At the base of trigonium and parameroids two slender strips extend obliquely forward over the open trough. Parameroids narrow, apically curving dorsad. Base of trigonium consisting of two converging struts with knee-shaped bend placing the straight very narrow trigonium ventrally from the parameroids. Its apex points ventrad. Parameres separate long narrow straight sclerites lying alongside the penis. The base is a thin rod, the caudal half a slender blade with sharply pointed slightly twisted tip. Delicate folds suggest the blades are internally twisted or in some way longitudinally folded.

Female. Ovipositor not distinctive. Sclerotised slender plates form a flat pear-shaped body, the prehensor. In front of it the ductus is inflated and covered with sharp spinules, resembling a porcupine fish. The rings on the seminal receptacle resemble those of *P. convolutus* in structure and shape, see there.

Note. Unmistakable because of the exceptionally long and slender trigonium and parameroids. The female is also distinctive. The species is named for Don H. COLLESS, formerly dipterist at CSIRO, Department of Entomology, who collected the present specimens but also many other small and new Scirtidae dealt with in this paper, or in studies on *Cyphon*-like taxa (ZWICK, in preparation).

Petrocyphon hamoni WATTS, 2011
(Figs. 66-68)

Material. 1 σ , Whitfield Ra. Forest Reserve, Cairns, N.Qld. 19 Apr. 1967 D.H. COLLESS (ANIC). 1 σ , N.Qld. [red ink on mounting card, apparently from coll. BLACKBURN] (SAMA).

Habitus. BL 1.7 mm. Light brown, no pattern. A3 longer than A2, more slender and narrower, almost as long as A4.

Male. Penis relatively flat, also the pala which is a little longer than the parameroids and the even shorter trigonium. Trigonium basally wide, narrowing in a curve to the short narrow apex which has a tiny sharp tip. The

parameroids are simple blades. The apices of parameroids and trigonium are surrounded by a bushel of colourless delicate filaments which seem to arise from under a lid-like structure at the base of the trigonium. Their precise nature remains unknown. The parameres lie along the sides of the penis. They are basally not connected but separate. Each consists of a slender basal rod which caudally widens to a narrow blade with terminal tip. Its precise shape depends somewhat on angle of view.

Notes. The present species was identified as *P. hamoni* from the illustration of the type (WATTS 2011, fig. 53) which shows the lid-like structure from which the hyaline filaments spread. WATTS (2011) took them for pilosity on the parameroids. The proportions of pala, trigonium, parameroids, and parameres are distinctive, being quite different from the other known species. C.H.S. WATTS kindly confirmed my interpretation. The present beetles are smaller than the only previously known specimen.

***Petrocyphon ovalis* n. sp.**
(Figs. 69-72)

Type material. Holotype ♂, Mt. Lewis Rd. 1000 m via Julatten N.Qld. 13 Sept.-10 Oct. 1987 A. WALFORD-HUGGINS rainf. interc. trap (ANIC).

Habitus. BL 2.1 mm. Light brown, head darkest. Antennae 3/5 total length of beetle, A3 about as long as A2 but thinner, less than half the length of A4.

Male. Penis contour oval, the narrow poles similar. Basal pole formed by the narrow anterior end of the pala which widens as its sclerotised edges diverge caudad. Near midlength the sclerites are wide and form an outwardly directed, partly membranous triangle. Distally from this point the sclerites divide into the trigonium and the narrow parameroids which converge and enclose the slender spinous tip of the trigonium between them. Their apices extend beyond the trigonium and lean against each other. Parameres separate. Membranes seem to loosely hold them at the triangular widenings of the penis. Each paramere is a thin long rod that divides near its base into two slender sharply pointed struts of different length and diameter.

Note. The name describes the unique contour of the penis.

The *messatos*-group

Strong asymmetry of the male genitalia is characteristic of this group. *Petrocyphon monga* WATTS, 2011 may belong here. The two species described below seem to be closely related. In both, the right paramere is shortened and in the firm grip of the right parameroid.

***Petrocyphon convolutus* n. sp.**
(Figs. 73-77)

Type material. Holotype ♂, 1 ♀, Woombye, Q., nr. Nambour 16.x.65 D.H. COLLESS (ANIC).

Habitus. BL 1.7-1.8 mm. Light brown, no pattern. A3 a minute sphere between A2 and A4 in the male, slightly elongate in the female.

Male. Penis and parameres asymmetrical, connected. Parameroids almost half as long as penis, curved, their slender apices crossing. The much shorter trigonium is a curved caudally slightly clubbed rod in the space between the two parameroids. Parameres rod-shaped, sharply pointed. The straight shorter one held in deep folds formed by pala and parameroid. The paramere runs caudally through a round complexly structured area (details unknown) in the parameroid, its sharp tip projects and extends across the trigonium. The longer left paramere is gently curved, its base is held by a fold of the pala. Its caudal half lies in a furrow on the surface of the parameroid and is held by a forward directed lobe on the medial edge of the parameroid. The sharp paramere tip is exposed.

Female. Ovipositor normal, not distinctive. Prehensor consisting of two lateral band-like sclerites over the front ends of which rests an irregularly folded approximately spherical body. In front of it is the entrance of some duct, either from the ovaries or some accessory gland. Still further in front follows a section with fine spicules and, near the midline, with triangular teeth the largest of which are arranged in several straight lines. The hyaline receptacle is covered by microscopic platelets with serrate edges. It carries two sclerite rings 90-100 µm in diameter. Inside the rings platelets are regularly arranged, like tiles.

Notes. The specific name describes the convoluted structure of penis and parameres.

***Petrocyphon messatos* WATTS, 2011**
(Figs. 78-80)

Material. 1 ♂, Eungas [reading ? probably Eungai 30° 49.661' S 152° 52.637' E] N.S.Wales. 2 ♂♂, 2 ♀♀, Upper Allyn River NSW, 14 Febr. 1968 D.H. COLLESS. 3 ♂♂, 3 ♀♀, 30.30S 152.23E NSW Wright's Lookout Track New England N. P. 16-18.Nov.1990 T.A. WEIR / Berleseate ANIC 1131 leaf litter under *Nothofagus moorei* & *Dicksonia antarctica*. 1 ♂, 18 mi Dorrigo-Coramba Rd., NSW, 18 April 1970 D.H. COLLESS. 2 ♂♂, 38.5 km WSW Coramba (30.14S, 152.43W) 26.vi.78, W. ALLEN (all ANIC).

Habitus. BL 1.7-1.9 mm. Light to dark brown with a darker mark on either side of the scutellum. A dark band just before midlength extends from the side towards the suture without reaching it. Antennae about half as long as the male, A3 minute, spherical.

Male. At first glance trigonium and parameroids appear almost symmetrical. However, the insertions lie on an oblique axis and the penis is at this level twisted which produces oblique folds basally from this point. Insertion of right parameroid shifted towards midline, its dorsal flange basally very wide, folding over the base of the left parameroid. Basally it possesses a curved sclerotised edge which firmly holds the hook-shaped paramere. A notch in the penis contour near the articulation of the trigonium apparently provides an anchoring point for the straight left paramere. At this point in some preparations a short outgrowth of the paramere is seen.

Female. The apodemes of T8 converge anteriorly in an arch but their tips remain separate. The prehensor is a flat carrot-shaped body located caudally from a stack of approximately semicircular folds. The diameter of the disc-shaped sclerites on the seminal receptacle is only 90-100 µm. The disc surface is generally lightly sclerotised but not sculptured, except the faintly marked rim.

Notes. *P. messatos* was immediately identified by the short hook-shaped right paramere.

Species incertae sedis

***Petrocyphon ovium* n. sp.**
(Fig. 81)

Type material. Holotype ♂, Sheepstation Cr. NSW 16 km NE of Wiangaree [28°30.659' S 152°57.778' E] 600 m 13 Jun-24 Aug.1982 S & J. PECK SBP36 // flight intercept. trap rainforest (ANIC).

Habitus. BL ca. 2.0 mm (damaged). Uniformly light brown. Elytral surface shining between dense punctuation. Eyes unusually large for the genus, frons between eyes only about as wide as 1.5 eye diameters. Antennae missing beyond segment 6, apparently short. Segment 3 very small, as short as pedicel but only about half as wide.

Male. Genitalia exceptional, pala of penis and base of tegmen basally connected, forming a basket-like structure. From it rises the long penis on one side, the curved long parameres from the other. The slender blade-like parameroids are about twice as long as the trigonium which rapidly narrows from the wide base to a sharp tip.

Female. Unknown.

Notes. The build of the genitalia is unique, close relatives are not known. The species name refers to the type locality, Latin *ovium*, a noun in plural form, genitive, meaning «of the sheep».

Discussion

Even though the number of known *Petrocyphon* species is more than doubled in this study the genus is probably far from being completely known. The number of available specimens of most species is low and species distinctions rely largely on male genitalia. Several females have distinctive genitalia but their association with males is usually simply based on common occurrence with males, habitus characters supporting assumed conspecificities are rare. Females of several species are unknown. At the same time, the studied material contained females corresponding to none of the known species. However, descriptions are not included because these females were not sufficiently distinctive to be unambiguously identified.

The genus *Petrocyphon* with its peculiar habitus has no obvious relatives among the Australian Scirtidae, nor elsewhere. However, several details that are used in taxonomy resemble conditions observed in members of the *micans*-group of the genus *Ypsilonocyphon* (descriptions of the Australian taxa in preparation, otherwise mainly Oriental). The two genera differ in other structures and are not necessarily related but attention is nevertheless drawn to these resemblances, for example:

- Granulous surface on dorsum of head, prothorax, scutellum, but impressed punctures on the elytra
- Apodemes of male T8 distinctly shorter than those of T9
- Frequent asymmetry of parts of the male genitalia
- Most females with complex prehensors composed of folded sclerotised cuticle lacking the usual large teeth and hooks
- Wall of the membranous seminal receptacle usually with a pair of sclerotised plates, discs, or rings

Acknowledgements

Almost all of the material used in my study was borrowed from Australian museums, over a period of more than 30 years. I would like to thank the helpful persons in charge of these collections (in alphabetical order): M. BARCLAY (MZL, London); D. BRITTON, D. SMITH (AMS, Sydney); C. LAMBKIN, G. THOMPSON (QMB, Brisbane); R. MARCHANT and the late A. NEBOISS (MV, Abbotsford); C.H.S. WATTS, J. FORREST, E. G. MATTHEWS, P. HUDSON (SAMA, Adelaide); T.A. WEIR, K. LEMAN (ANIC, Canberra).

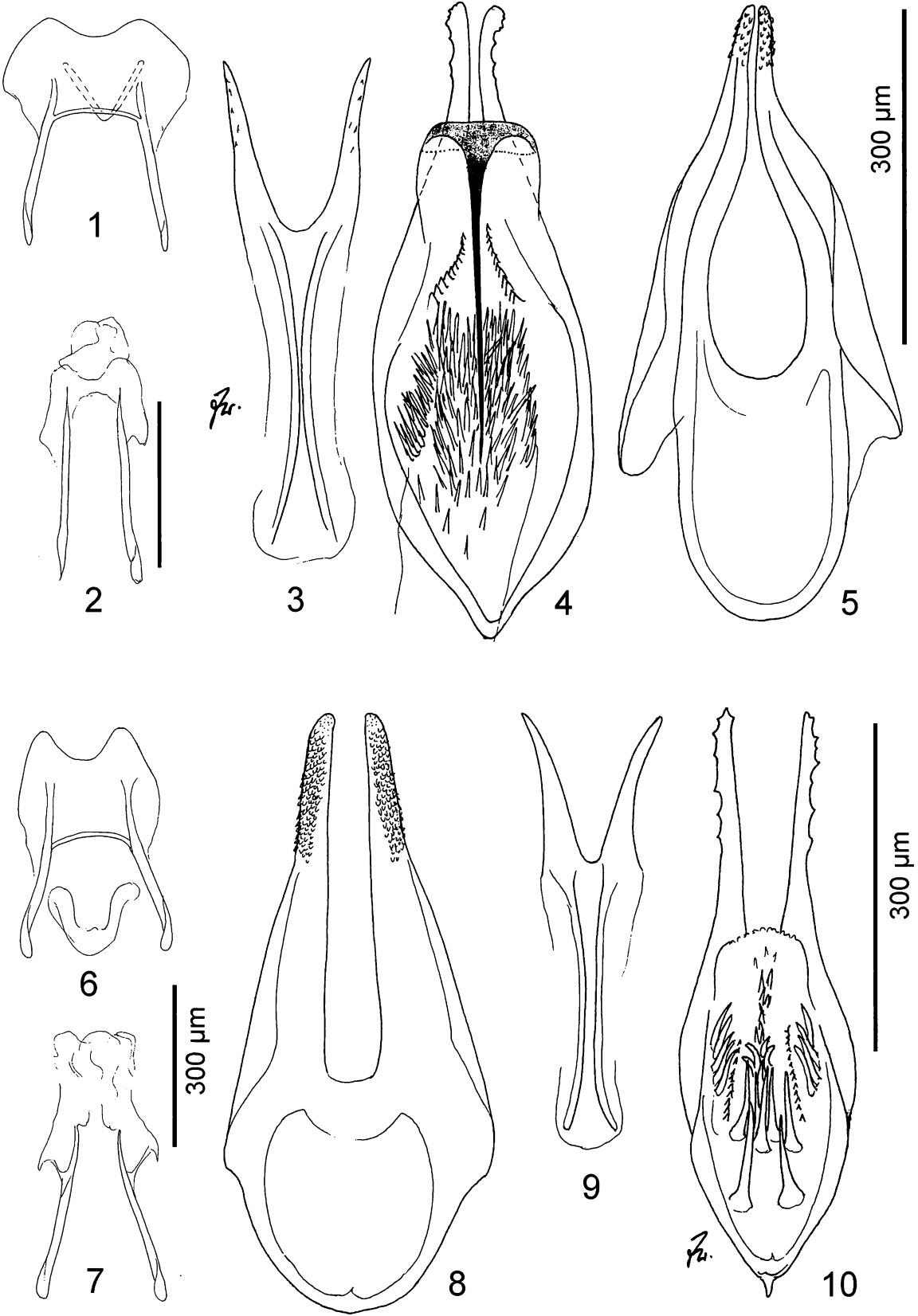
R. RUTA (Wrocław), B. KLAUSNITZER (Dresden) and C.H.S. WATTS (Adelaide) are sincerely thanked for constructive criticism of a draft. R. RUTA generously forwarded material of new or incompletely known species for inclusion in the present paper which is much appreciated. Special thanks are extended to CHRIS WATTS (Adelaide) for help with information from historical catalogues and collectors' notebooks and lastly but not least for improving my English.

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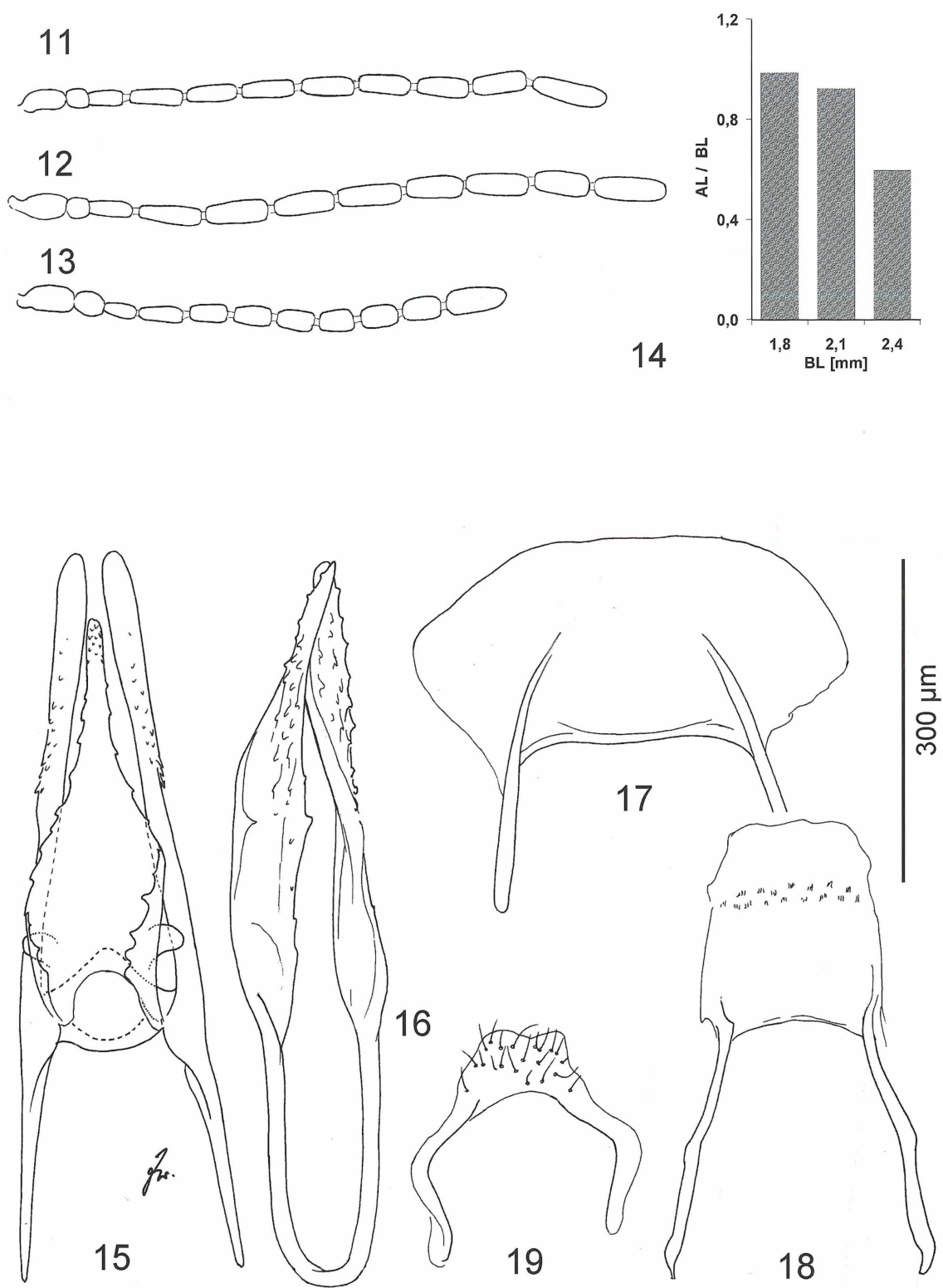
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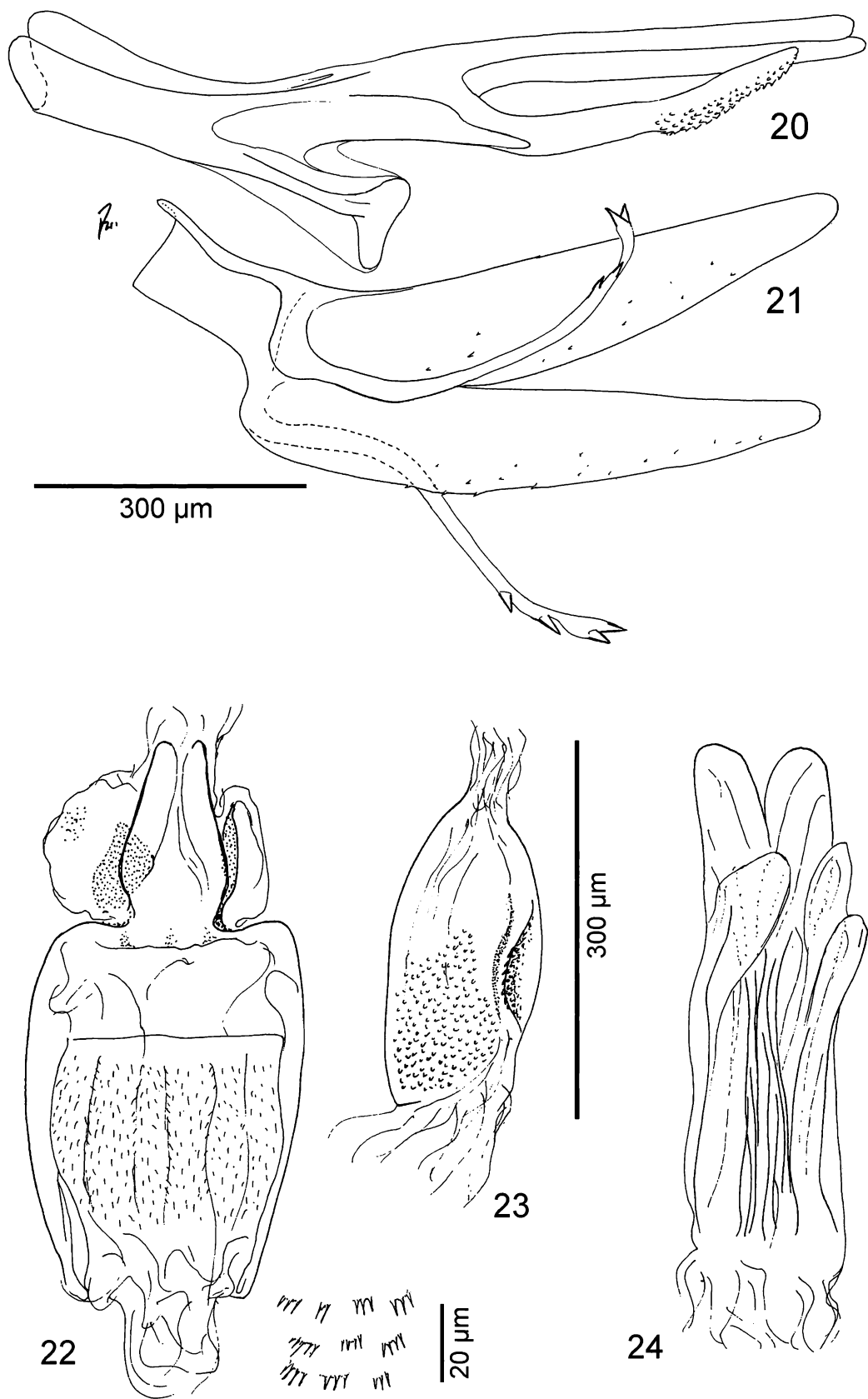
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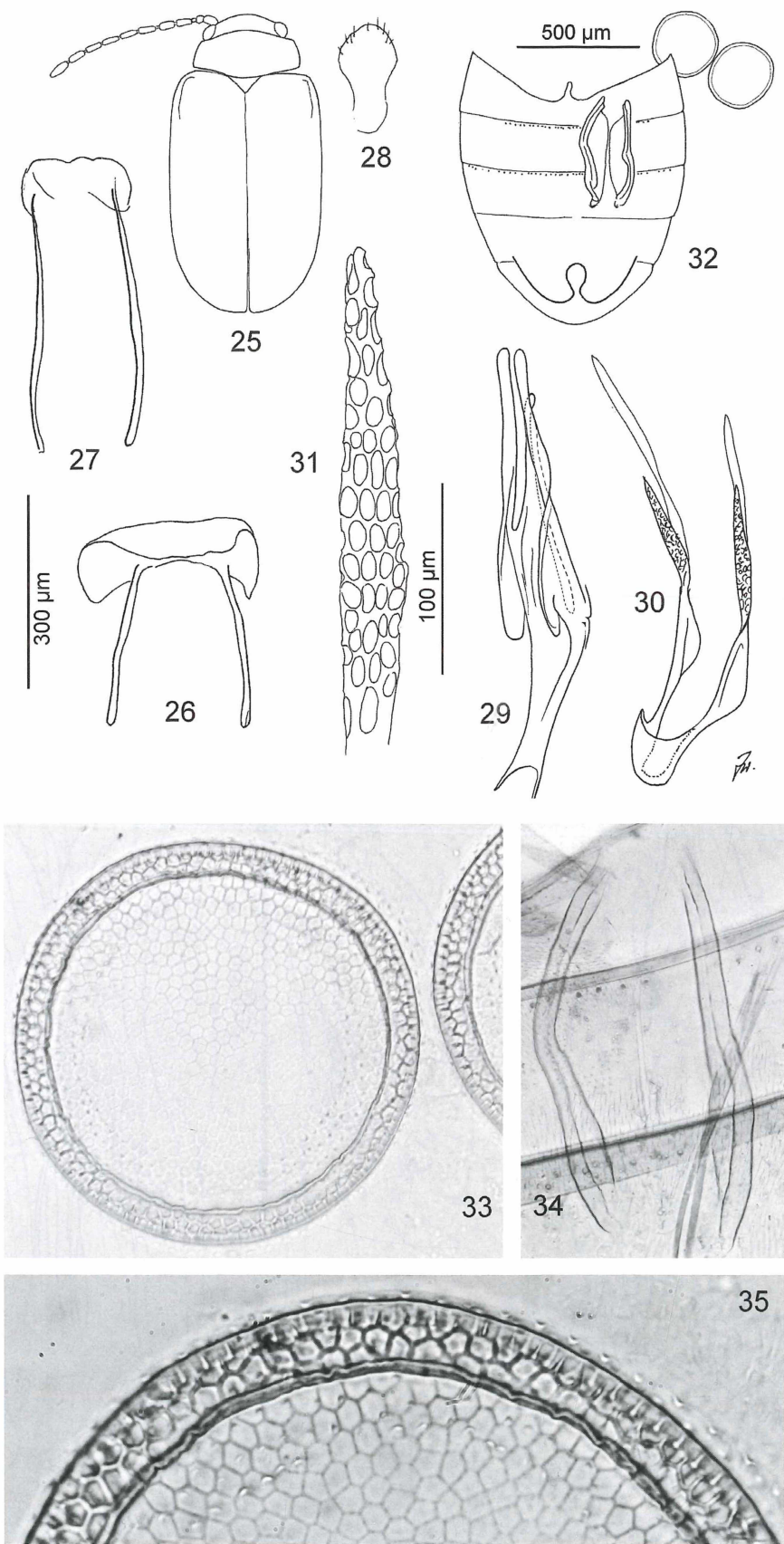
Figs. 1-5: *Petrocyphon antarcticus* WATTS, ♂. (1) T8; (2) T0; (3) S9; (4) penis ventral; (5) tegmen and parameres. Both scale lines are 300 μ m long; the short line applies to figs. 1 and 2. Figs. 6-10: *Petrocyphon wattsi* n. sp., male. (6) T8 and S8; (7) T9; (8) tegmen and parameres; (9) S9; (10) penis ventral.



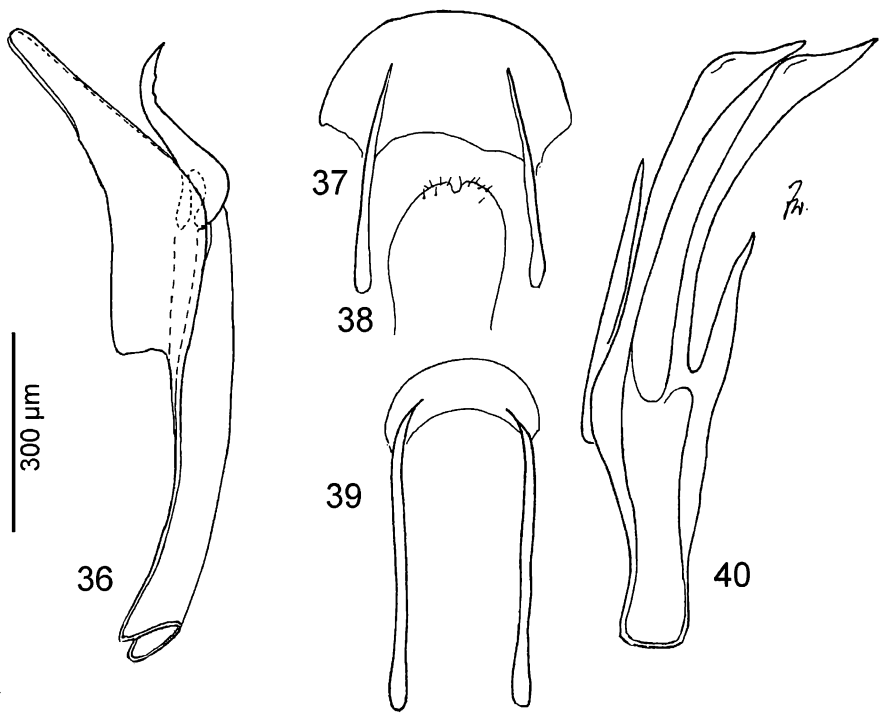
Figs. 11-14: *Petrocyphon wattsi* n. sp., ♂. (11) negative allometry of antennal length; AL, length of antenna, BL, length of body; (12-14) antennae of the same three males as in Fig. 11, in the same order. Figs. 15-19: *Petrocyphon cataractae* n. sp., ♂. (15) penis; (16) parameres; (17), T8; (18) T9; (19) S9.



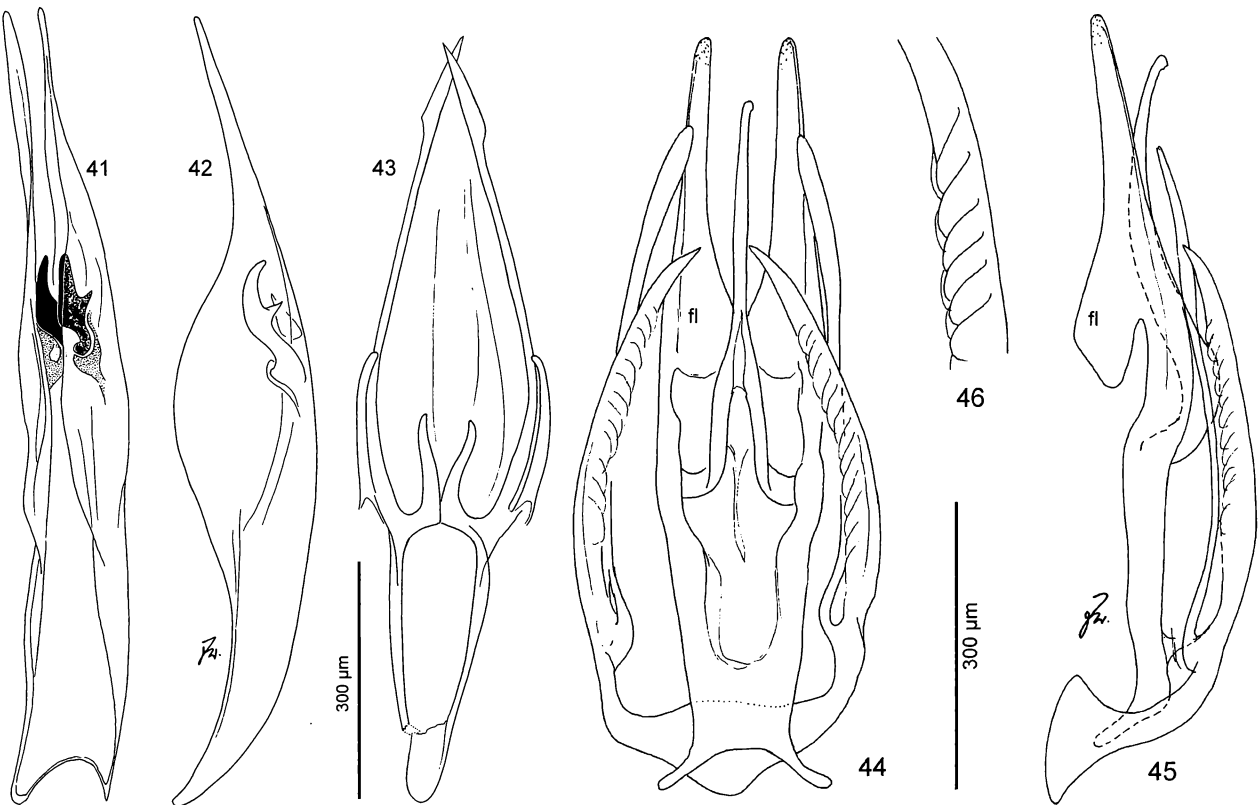
Figs. 20-21: *Petrocyphon flagellifer* n. sp., male. (20) penis, oblique lateral view; (21) tegmen and parameres, lateral. Figs. 22-24: Prehensors of several Tasmanian *Petrocyphon* species, diagrammatic. (22) *P. antarcticus* WATTS; (23) *P. wattsi* sp.n.; (24) *P. flagellifer* n. sp.



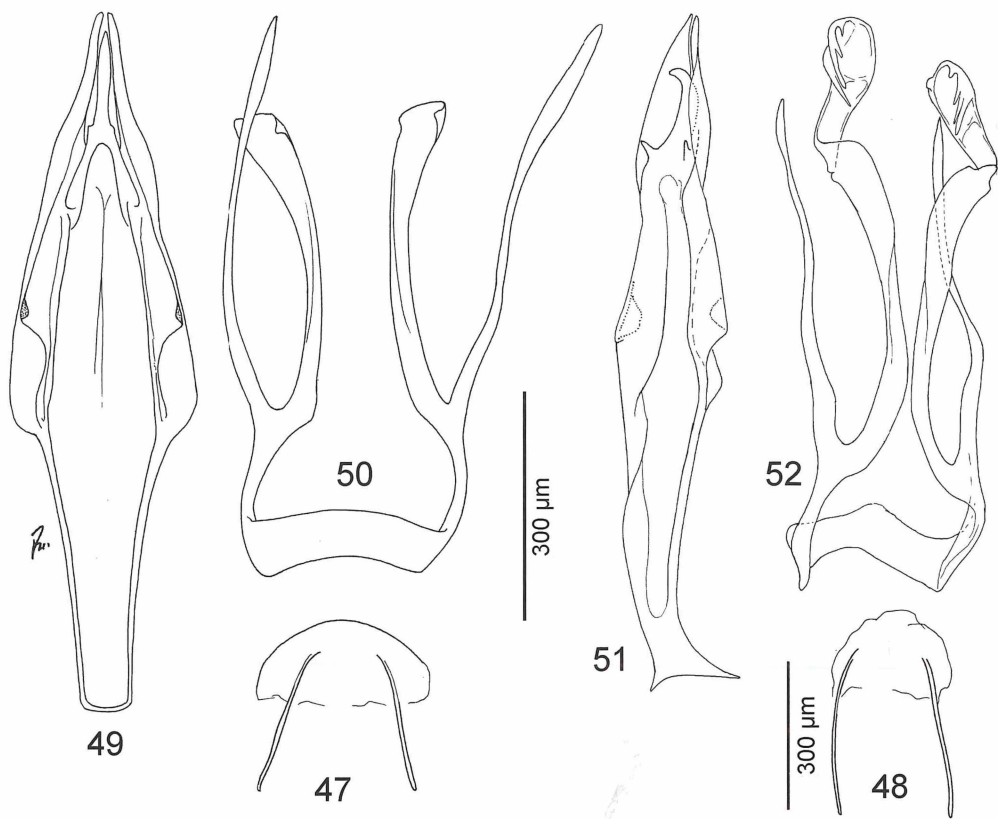
Figs. 25-32: *Petrocyphon julianae* n. sp. (25) ♂ habitus, diagrammatic; (26) T8; (27) T9; (28) S9; (29) penis; (30) tegmen and parameres; (31) tip of dorsal branch of paramere; (32) diagrammatic overview of female abdomen with prehensor and receptacular rings. Figs. 33-35: *Petrocyphon julianae* n.sp. ♀. (33) spermathecal ring; (34) detail of same; (35) prehensor.



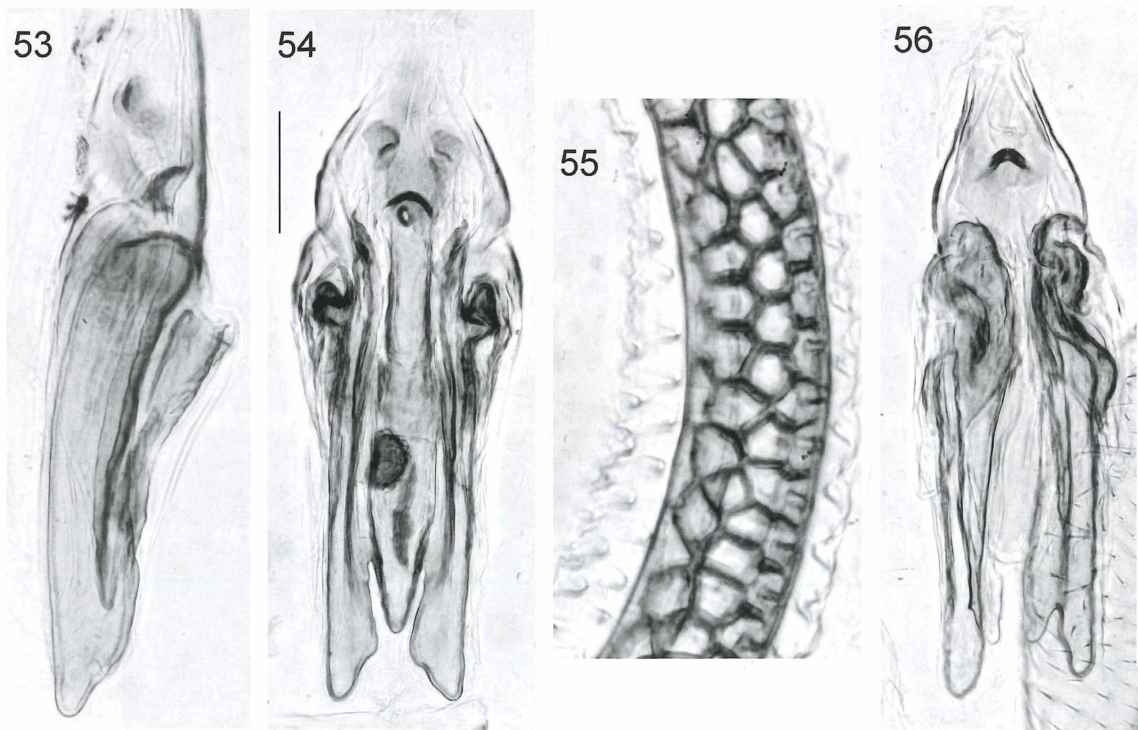
Figs. 36-40: *Petrocyphon nothofagi* n. sp., ♂. (36) penis lateral; (37) T8; (38) S9; (39) T9; (40) tegmen and parameres.



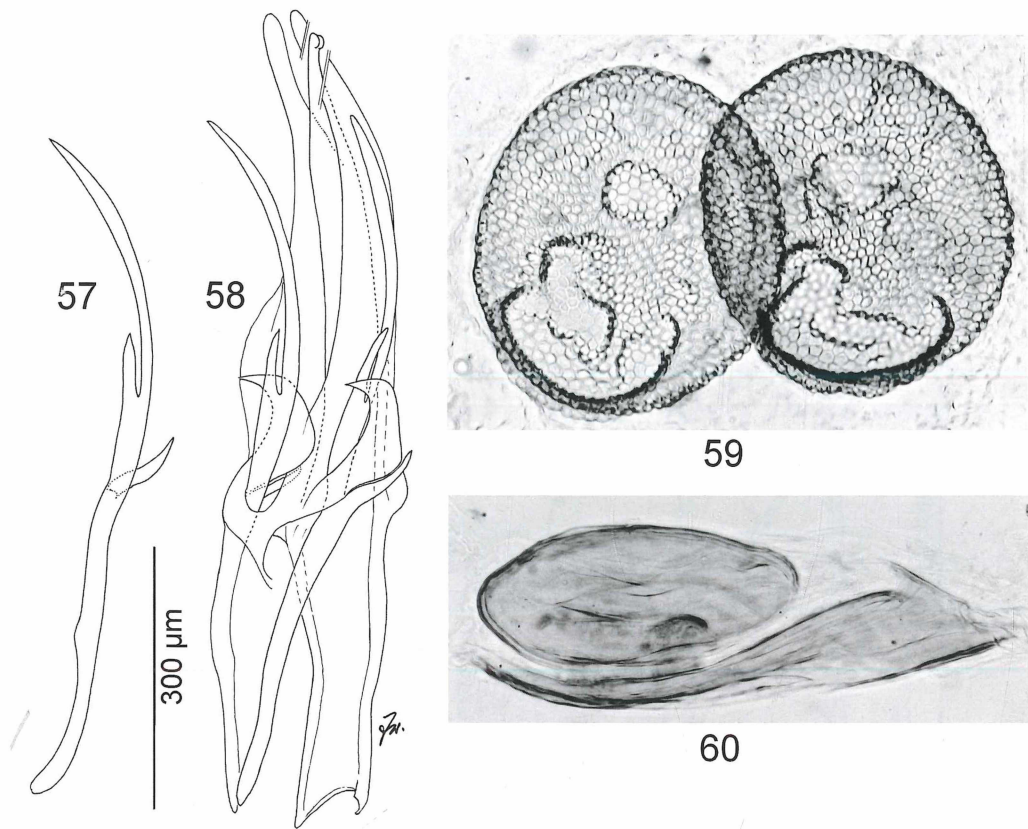
Figs. 41-43: *Petrocyphon lamingtonensis* sp. n., ♂. (41) penis in slightly oblique ventral view; (42) the same, lateral view; (43) tegmen and parameres, dorsoventral view. Figs. 44-46: *Petrocyphon phoenix* WATTS, ♂. (44) penis and parameres, dorsal; (45) same, lateral.



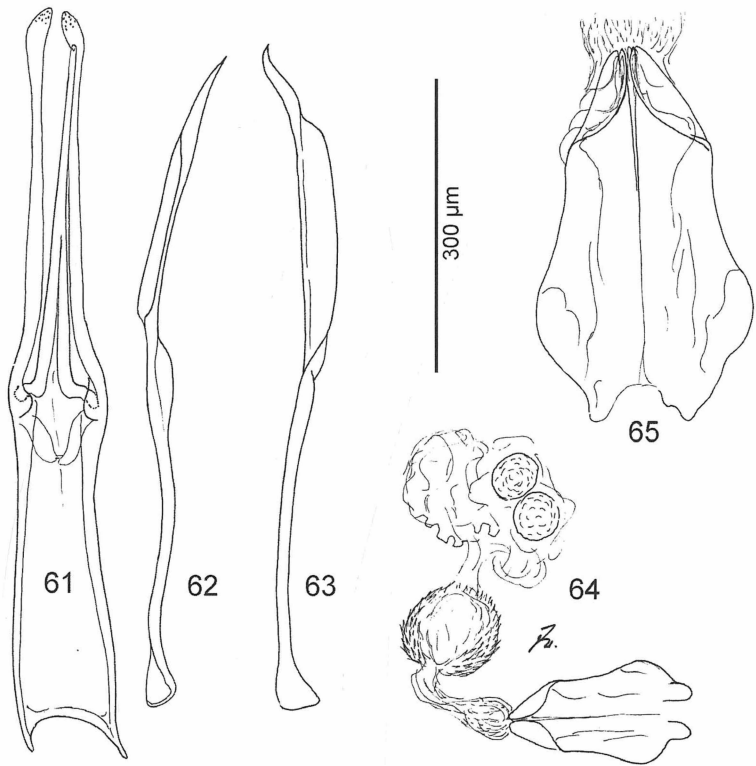
Figs. 47-52: *Petrocyphon tasmanicus* n. sp., ♂; (47-50) holotype from Lottah, (51-52) specimen from Hellyer River. (47) T8; 48, T9; (49, 51) penis dorsal; (50, 52) tegmen and parameres.



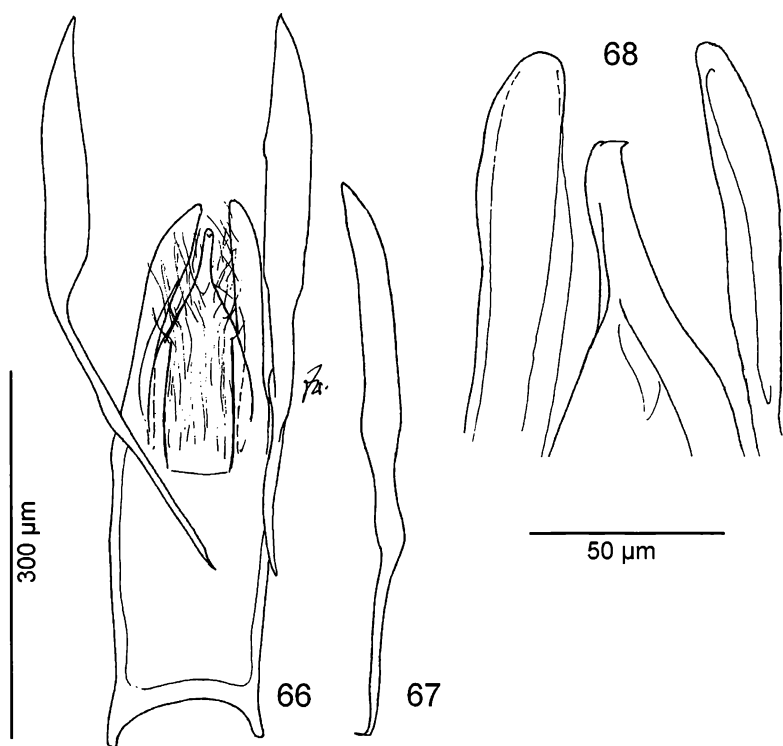
Figs. 53-56: *Petrocyphon tasmanicus* n. sp., ♀; (53-55), female from Launceston, (56) specimen from Hellyer River. (53) pre-hensor lateral; (54, 56) same, dorsal; (55) detail of spermathecal ring.



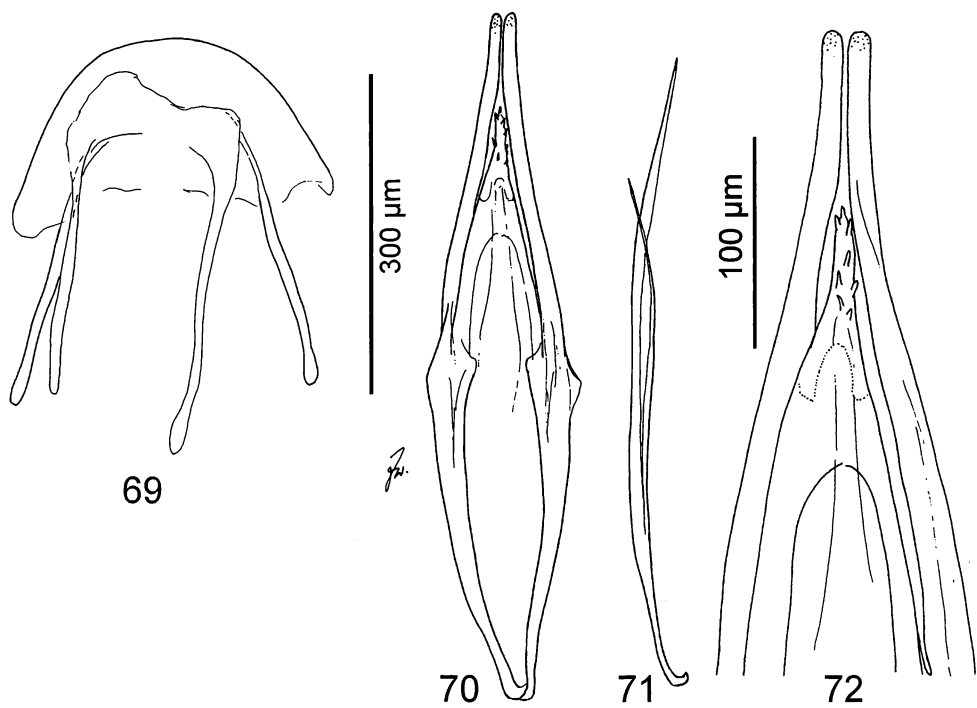
57-60: *Petrocyphon bihamatus* n. sp. (57) isolated paramere; (58) penis and parameres in natural position, oblique lateral view with a window cut into the left parameroid to show the trigonium tip. (59) spermathecal discs; (60) prehensor, lateral.



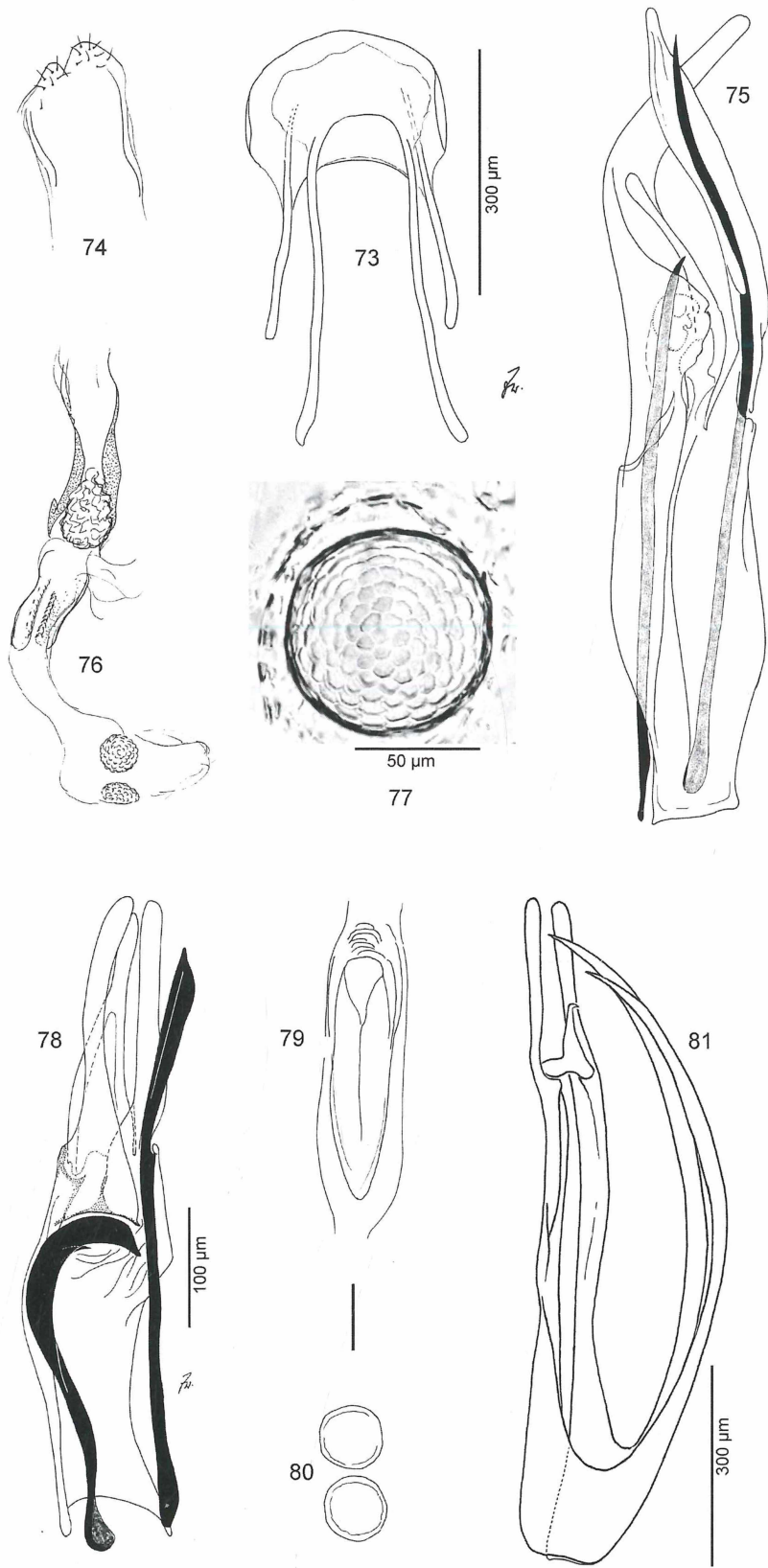
Figs. 61-65: *Petrocyphon collessi* n. sp. (61) penis, dorsal view; (62- 63) different views of isolated paramere. (64) overview of female genitalia; (65) prehensor, dorsal view.



Figs. 66-68: *Petrocyphon hamoni* WATTS, ♂. 66, penis and parameres, dorsal view; 67, isolated paramere; 68, tip of penis and parameroids of another specimen, slightly oblique view.



Figs. 69-72: *Petrocyphon ovalis* n. sp. (69) ♂ T8 & T9; (70) penis, dorsal; (71) isolated paramere; (72) detail of tips of trigonium and parameroids. Figs. 73-77: *Petrocyphon convolutus* n. sp.



Figs. 73-77: *Petrocyphon convolutus* n. sp. (73) ♂ T8 & T9; (74) S9; (75) penis and parameres, dorsal view, parameres black.; (76) overview of female organs; (77) receptacular disc. Figs. 78-81: (78-80) *Petrocyphon messatos* WATTS: (78) penis and parameres, dorsal view; parameres black or grey shade where hidden by other structures; (79) prehensor; (80) receptacular discs. (81) *Petrocyphon ovium* n. sp. penis and parameres, oblique lateral view.

